A POLICY BRIEFING BOOK

THE BASIC PRINCIPLES OF SUSTAINABLE AGRICULTURE

(also called "Alternative Agriculture" and "LISA")

February 1991

An introduction for farmers, environmentalists, the public, and policy-makers

PREFACE

Many kinds of people — not only farmers but also legislators, congressional staff, lobbyists, new employees of USDA and of the food and fiber industry, and interested public — come to USDA looking for a quick way to understand farm policy. This series of booklets is addressed to that wide audience and is intended as an introduction to the key concepts.

The booklet is meant to work in the same general way as an informal briefing, such as one given with a series of overhead transparencies. Each page of the booklet contains a single "screen" of illustrative material, accompanied above and below by an "instructor's comments" — all of which is followed by a question to the reader. The answer to each such question will be found on the next page of the briefing.

As background for this booklet, readers might like to review the concepts covered in The Basic Mechanisms of U.S. Farm Policy. See back cover for ordering information.

This booklet is based on materials supplied by the Cooperative State Research Service working with the Extension Service, both of the U.S. Department of Agriculture, and others. It was prepared by William J. Hudson and Jonathan Harsch of Maumee, Ohio, under contract with the U.S. Department of Agriculture.

Researchers and policy makers are frequently asked to define "sustainable agriculture."

MAIN CRITERIA FOR "SUSTAINABLE AGRICULTURE"

As defined by Congress, sustainable agriculture is "an integrated system of plant and animal production practices having a site-specific application that will, over the long term:

"1. satisfy human food and fiber needs;

"2. enhance environmental quality and the natural resource base upon which the agricultural economy depends;

"3. make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls;

"4. sustain the economic viability of farm operations; and

"5. enhance the quality of life for farmers and society as a whole."

Question. How long has U.S. farm legislation been concerned with the second criterion above, maintaining or enhancing the natural resources available for future food production?

FARM LEGISLATION AFFECTING SUSTAINABILITY 1862-1985

Farm Act	Key public concerns	Provisions affecting sustainability
1862	Building a nation	Homestead Act subsidized sodbusting
1935	Drought, wind erosion, farm bankruptcies, conservation	USDA Soil Conservation Service (SCS) created
1936	Conservation and crop surpluses	Direct payments by SCS to farmers to subsidize conservation practices
1949	Surpluses, low prices, and erosion	USDA price supports link production control with conservation programs
1956	Surpluses, low prices, and erosion	Long-term Soil Bank and Great Plains Conservation programs launched to idle erodible land for up to 10 years
1965	Meeting export demand	Acreage reduction programs replaced by fencerow-to-fencerow planting (early 1970s)
1977	Cost effectiveness; paying farmers not to produce	Cost-sharing assistance limited to identified conservation needs
1981	Meeting global food demand	Conservation cost-sharing rules tightened to separate conservation from production control
1985	Surpluses, conflict between price support programs and conservation	Conservation Reserve Program, Sodbuster, Swampbuster programs; research on "alternative farming"

Question. *What did the 1985 farm bill mean by "alternative farming"?*

The 1985 farm bill mandated research into "alternative agriculture," characterized by reduced reliance on purchased inputs and by encouragement of soil-building, non-depleting or "sustainable" farming practices.

THE FOOD SECURITY ACT OF 1985

On the research side, the bill required scientific investigation to:

- enhance agricultural productivity;
- maintain the productivity of land;
- reduce soil erosion and loss of water and plant nutrients; and
- conserve energy and natural resources...

In 1988, the requirement to encourage "low-input, sustainable" practices led to acceptance of the term "LISA," an acronym for Low Input/Sustainable Agriculture.

Question. What new programs were established by the 1990 farm bill to encourage sustainable agriculture?

The 1990 farm bill, together with the 1990 budget reconciliation bill, broadened existing conservation programs, created new programs and relaxed crop acreage base provisions – all of which will provide greater options to farmers.

NEW AND BROADENED PROGRAMS UNDER THE FOOD, AGRICULTURE, CONSERVATION, AND TRADE ACT OF 1990

- Created the Agricultural Water Quality Protection Program, which is to enroll as much as 10 million acres near wellheads, areas inhabited by endangered species, or where agricultural production poses a threat to the quality of water
- Created the Integrated Farm Management Program, which is a voluntary program to encourage farmers to plant conserving crops without losing official crop base acreage
- Broadened the existing Conservation Reserve Program (CRP) to include cropland that adversely affects water quality

Question. What is meant by the new "flexibility" provisions of the 1990 farm legislation, and how will these new rules affect sustainable agriculture?

The 1990 farm legislation removes cross compliance requirements for participating farmers and decreases by 15 to 25 percent the acreage on which farmers will be eligible for price support deficiency payments. But farmers may plant other crops on these 15-25 percent "flex acres" without losing crop acreage base.

CROPS ELIGIBLE TO BE PLANTED ON NONPAID PERMITTED ACRES UNDER 1990 FARM LEGISLATION

- Program crops: wheat, feed grains, rice and cotton
- Oilseeds: soybeans, sunflower seed, canola, rapeseed, safflower, flaxseed, mustard seed and other oilseeds as determined by the Secretary
- Other crops, except fruits and vegetables
- Any experimental or industrial crop designated by the Secretary

Under previous legislation, farmers could not switch acreage to these crops without losing Crop Acreage Base for future price support payment. The new Planting Flexibility provisions protect the farmer's base while permitting interested farmers to consider alternatives such as sustainable agriculture.

Question. Does interest in sustainable agriculture mean a rejection of all the principles of modern farming today?

Certainly not. Criticism of sustainable agriculture has arisen mainly from lack of information, from oversimplifications of the transition problems for farmers, and from exaggerated claims of its future contribution.

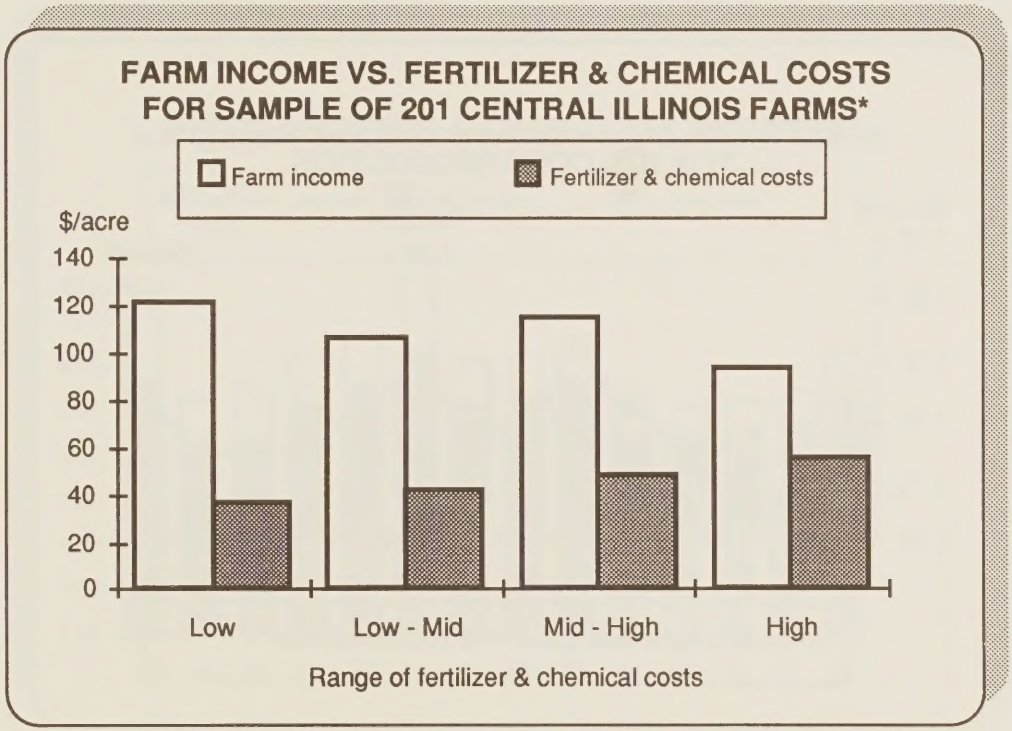
SUSTAINABLE AGRICULTURE: WHAT IT IS NOT

- A break with modern agriculture
- Another name for organic farming
- Only for small farms
- Only for livestock farms
- A step backward
- A panacea for all environmental problems
- A complete solution to farm profitability problems
- A budget-buster for USDA

The USDA's sustainable agriculture program is designed to develop a full range of options for all farmers – not to impose limitations on any farmer. This is why the program is often rightly referred to as "alternative agriculture" or "alternative farming."

Question. What have researchers shown about the farm income effects of reduced reliance on purchased inputs?

One study at the University of Illinois concluded that "lower amounts of fertilizers and chemicals may actually enhance profits." Whether a specific farmer could enhance profits while reducing pesticide and fertilizer inputs is a complex question. The answer depends on the farm's crop history, previous input use, management ability, weather and a variety of other factors such as weed and plant population.

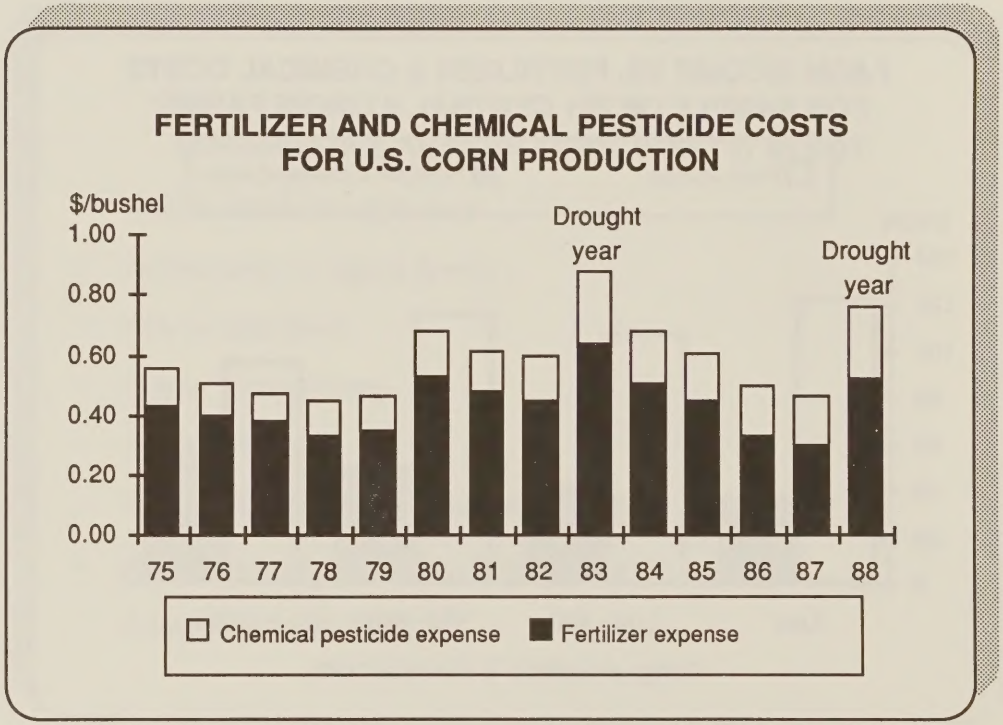


*Source: "Farm Profitability and Input Use," by Kevin W. Koenigstein, Robert H. Hornbaker, and David A. Lins, University of Illinois, 1990.

NOTE: This case and this booklet focus on the Midwest corn belt as representative of current problems and possible solutions. Because sustainable agriculture often requires highly site-specific practices, consideration of other regions is not possible here. But this booklet does outline general principles with broad applicability.

Question. Can the above conclusion be applied to all of U.S. farming?

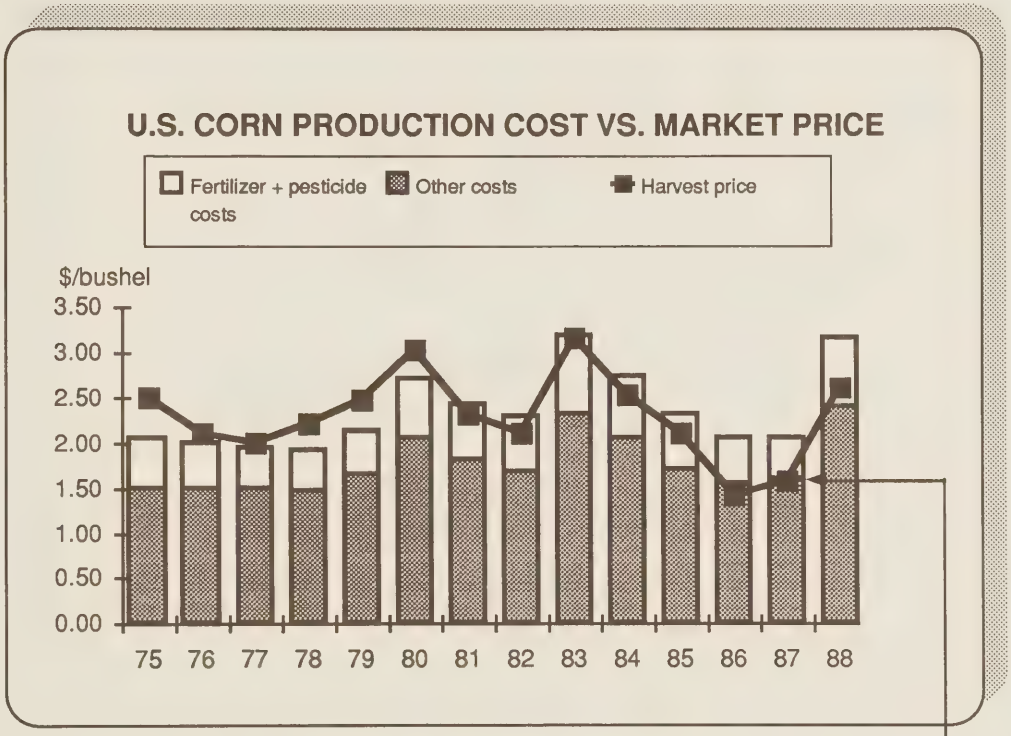
No. The main conclusion of the study is that not every farmer would benefit from cutting back on commercial fertilizers and pesticides – but that every farmer should have the option of reducing chemical inputs ... because some farmers could boost their profits significantly. The trend to lower chemical input cost per bushel can already be seen in the USDA data below.



Note: Cost per bushel is higher in drought years, as in 1983 and 1988, because of the reduced number of bushels produced.

Question. Hypothetical case. If expenditure on chemical fertilizers and pesticides could be significantly reduced, would the U.S. corn farmer be profitable at currently prevailing market prices?

Hypothetical case. Even assuming no change in corn yields or price, a significant reduction in fertilizer and pesticide use would not automatically guarantee profitability to corn farmers in all years. The weather, cropping history, and other management factors are crucial. Also, global factors, such as world demand and export competition, have a large role to play, especially in determining market price.

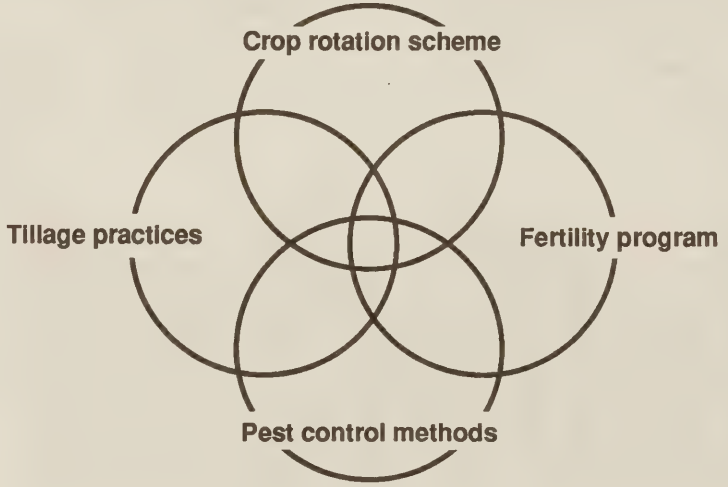


When market price is below the total cost of production, corn farmers must rely on government payments to make farm income positive – a condition which does not contribute to long-term sustainability.

Question. Besides the fertilizer and pesticide costs shown above, what items make up the "other costs"?

Other costs include seeds, fuel, machinery, labor and management. For purposes of distinguishing between "sustainable agriculture" and "conventional farming" a farming system can be discussed in terms of four main elements -- rotation, tillage, fertility, and pest control.

ELEMENTS OF THE CROP FARMING SYSTEM



The four elements are interwoven and interdependent -- and also dramatically affected by specific soils, climates, and markets.

Question. What is the usual Crop Rotation Scheme for most present day U.S. corn farming ("conventional farming")?

CROP ROTATIONS USED ON U.S. LAND PRODUCING CORN IN 1988

Crop planted by year			Percent of
1986	1987	1988	1988 corn area
Corn	corn	corn	26
Soybeans	corn	corn	5
Alfalfa	corn	corn	3
Other	corn	corn	3
Corn	soybeans	corn	38
Soybeans	soybeans	corn	4
Other	soybeans	corn	3
Corn	wheat	corn	1
Other	wheat	corn	3
Alfalfa	alfalfa	corn	4
Other	alfalfa	corn	1
Corn	oats	corn	1
Other	oats	corn	1

About three-quarters of the country's corn crop is grown in continuous corn or in alternate years with soybeans – a mono- or dual-cultural practice made possible with purchased inputs of fertilizers and pesticides.

Question. What concerns arise from the above Crop Rotation Scheme for the continuous cropping of corn?

A number of potential hazards to long-range sustainability can be listed for continuous cropping, centering on interference with natural soil processes.

POTENTIAL HAZARDS OF CONTINUOUS CROPPING

Repeated use of fertilizers and pesticides in continuous row crop farming can:

- Suppress soil fertility, especially compared to organic nitrogen sources such as legumes and manures;
- Decrease soil productivity, because of compacted soil structure, reduced ion exchange capacity, and less microbial activity;
- Destroy natural predators of crop pests;
- Increase erosion and the leaching of chemicals to groundwater.

<u>Question</u>. What kind of crop rotation scheme is found among practitioners of alternative agriculture? (Note. The terms "alternative agriculture," "alternative farming," and "sustainable agriculture" are used interchangeably.)

SOME SAMPLE CROP ROTATION PATTERNS USED IN ALTERNATIVE AGRICULTURE EXPERIMENTS

Year	Rotation entry point for each field		
	1	2	3
1981	oats red clover	soybeans	corn
1982	corn	oats red clover	soybeans
1983	oats red clover	corn	oats red clover
1984	corn	wheat hairy vetch	corn
1985	soybeans	corn	oats red clover
1986	oats legume mix	barley soybeans	corn
1987	hay	wheat legume mix	wheat soybeans

Some agronomists prefer the term relay cropping to rotation because the crop sequences are never perfectly regular. Changes are made due to weather and due to increased knowledge of soils, markets, and other local conditions.

Question. What are some of the general principles of sequencing crops in so-called relay cropping?

The main purposes of rotation or relay cropping are to build soil productivity and to interrupt the normal sequences in the lives of pests.

GENERAL PRINCIPLES IN THE SEQUENCING OF CROPS IN SUSTAINABLE AGRICULTURE

- Following N-fixing legumes with high users of N
- Alternating cool and warm season crops
- Preceding a slow-growing, non-competitive crop with a weed-suppressing crop
- Alternating deep- and shallow-rooted crops
- Employing weed-suppressing allelopathic crops such as oats or sorghum
- Alternating high and low users of water if this resource is limiting
- Allowing a sufficient time interval before repeating a crop which is vulnerable to insect and disease pests

Let's move now from Crop Rotation Schemes to Tillage Practices.

Question. How can conventional farming and alternative farming be compared in terms of Tillage Practices?

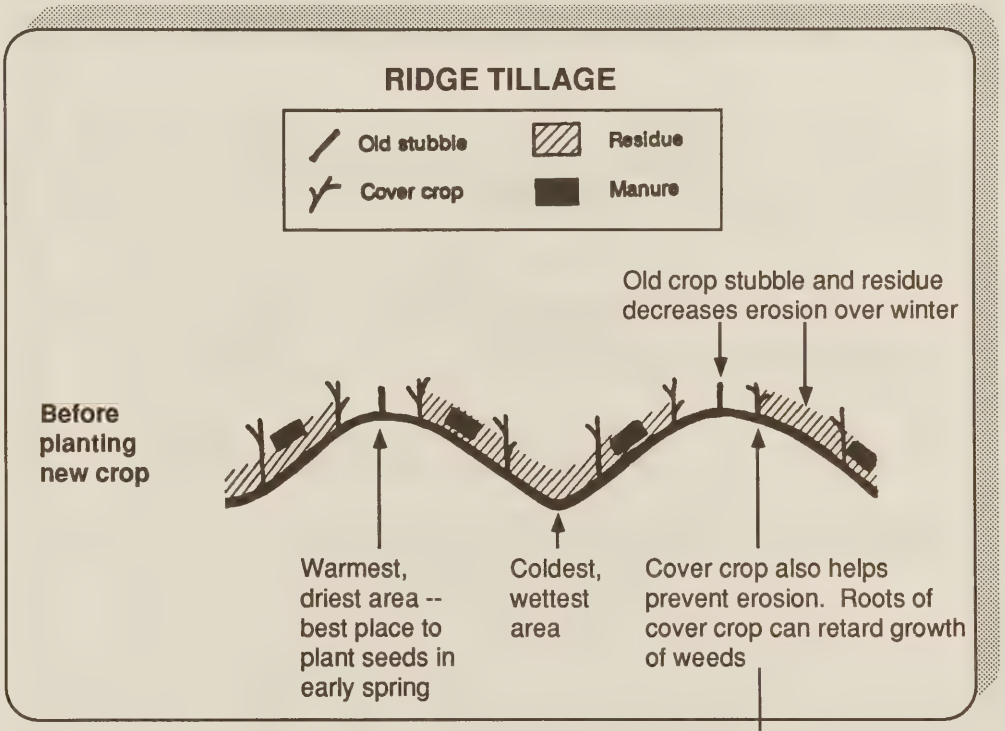
Conventional farming still relies on minimum-till, no-till or moldboard plowing, whereas alternative farming emphasizes ridge till.

CONVENTIONAL VS. ALTERNATIVE CROP FARMING SYSTEMS

Element of farming system	Conventional Farming	Alternative Farming
Crop rotation	Corn-corn-corn or corn-soybeans-corn	Multiple crops, emphasis on legumes and winter cover
Tillage practices	Minimum-till, no-till or moldboard plowing	Ridge till whenever possible

<u>Question</u>. What is "ridge tillage" and how does it fit in with sustainable agriculture?

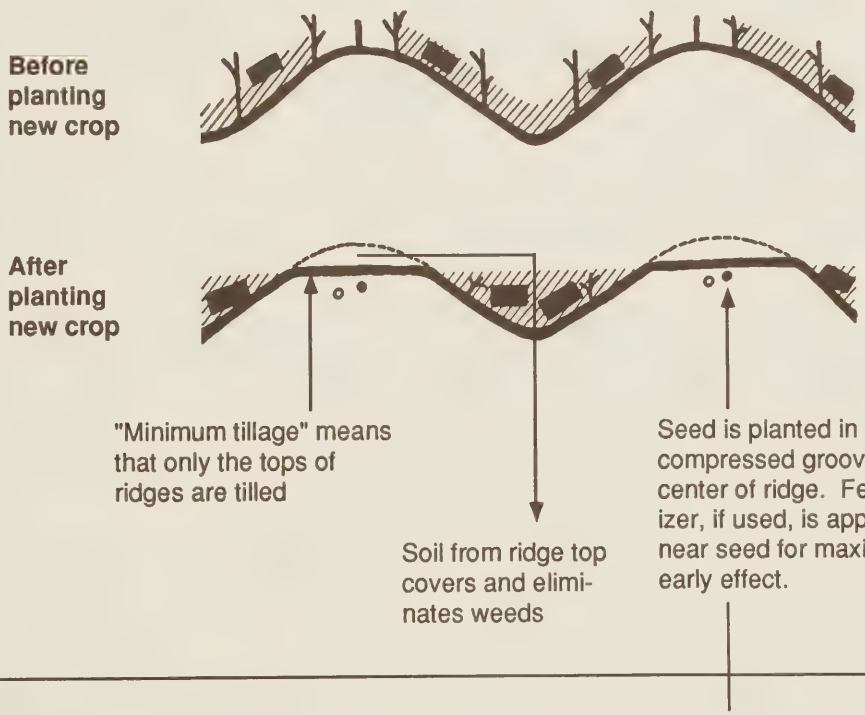
Ridge tillage, a form of conservation tillage with significant erosion control benefits, overcomes some of the soil temperature, weed control, and soil compaction problems associated with conventional practices.



Roots of cover crops emit natural compounds which are poisonous to certain weeds. Process is called "allelopathy."

<u>The next page</u> shows how only the tops of the ridges are tilled in the spring, exposing much less than the field's total surface to wind and erosion.

RIDGE TILLAGE, continued



Fertilizer application in this manner is called "banding," as opposed to "broadcasting" over entire field.

The next page shows the remainder of the ridge till pattern, with emergence of new crop and final rebuilding of the ridges.

RIDGE TILLAGE, continued

Question. *How can conventional farming and alternative farming be compared in terms of Fertility Programs and Pest Control Programs?*

Conventional farming still relies on minimum-till, no-till or moldboard plowing, whereas alternative farming emphasizes crop rotations, mechanical cultivation, and innovative practices such as ridge till.

CONVENTIONAL VS. ALTERNATIVE CROP FARMING SYSTEMS

Element of farming system	Conventional Farming	Alternative Farming
Crop rotation	Corn-corn-corn or corn-soybeans-corn	Multiple crops, emphasis on legumes and winter cover
Tillage practices	Minimum-till, no-till or moldboard plowing	Mechanical cultivation and ridge till whenever possible
Fertility program	Chemical fertilizer (NPK)	Legumes in rotation, greater use of organic N, less chemical N, P and K; soil structure regeneration
Pest control method	Routine application of chemical pesticides	Low input, biological controls, mechanical cultivation, crop rotation, disease-resistant cultivars, scouting for pests and beneficials; applying chemical pesticides as a last resort.

Late Spring soil nitrogen test before side-dressing now becoming "conventional."

Emphasis on less total input, on soil structure, and on pest cycle interruption.

<u>Question</u>. What kind of nitrogen fertility program is recommended for alternative agriculture?

The P and K transition recommendations are keyed to specific needs of the crops and the nutrient balance in the soil.

PHOSPHATE AND POTASH FERTILITY PRINCIPLES IN ALTERNATIVE AGRICULTURE

- Unlike N, which can be added to crop-soil system via symbiotic fixation, the soil supply of P and K can only be replenished by external sources;
- The supply of P and K may be in surplus from conventional crop farming, and may not need replenishment for several years -- especially if improved soil structure, organic content, and pH levels act to increase the availability of existing supplies of P and K to plants;
- Sources of additional P favored by alternative farmers are rock phosphate as opposed to superphosphates (acid-treated), especially in a rotation scheme with green manures or with composting; animal manure is also an important possible source of phosphorus;
- Sources of K favored by sustainable-agriculture farmers are low analysis rock dust as opposed to KCl; more processed K may be needed during transition to sustainable agriculture.

<u>Question</u>. What kind of weed and insect control methods are recommended for sustainable agriculture?

The weed and insect control methods of alternative-agriculture farmers are intimately related to the crop rotation scheme, the tillage practices, and the population dynamics of pests and their natural enemies.

PEST CONTROL METHODS IN SUSTAINABLE AGRICULTURE

- Interrupting weed and insect life cycles with rotation scheme;
- Ridge tillage;
- Allelopathy (plant tissue residues emitting natural herbicides);
- Mechanical cultivation;
- Adjusting planting rate, time of planting, row and seed spacings, and altering choice of crop or variety;
- Integrated pest management (IPM), which includes regular scouting and "biocontrol" use of other insects and pathogens to fight pests;
- Use of "biologically based" pesticide formulations;
- Focus on economic threshold of weeds rather than visual threshold.

**Cultivating at least once for weed control is generally agreed to boost corn and soybean yield in <u>conventional</u> farming, even when chemical control of weeds is good.*

<u>Question</u>. How can the differences between conventional farming and alternative agriculture be summarized, and what are the main concerns of farmers who attempt to make the transition?

Once again, no foolproof "recipe" is available for converting a fertility program to sustainable agriculture, but certain concepts and principles can be discussed which will apply in many cases.

NITROGEN FERTILITY PROGRAM PRINCIPLES IN ALTERNATIVE FARMING

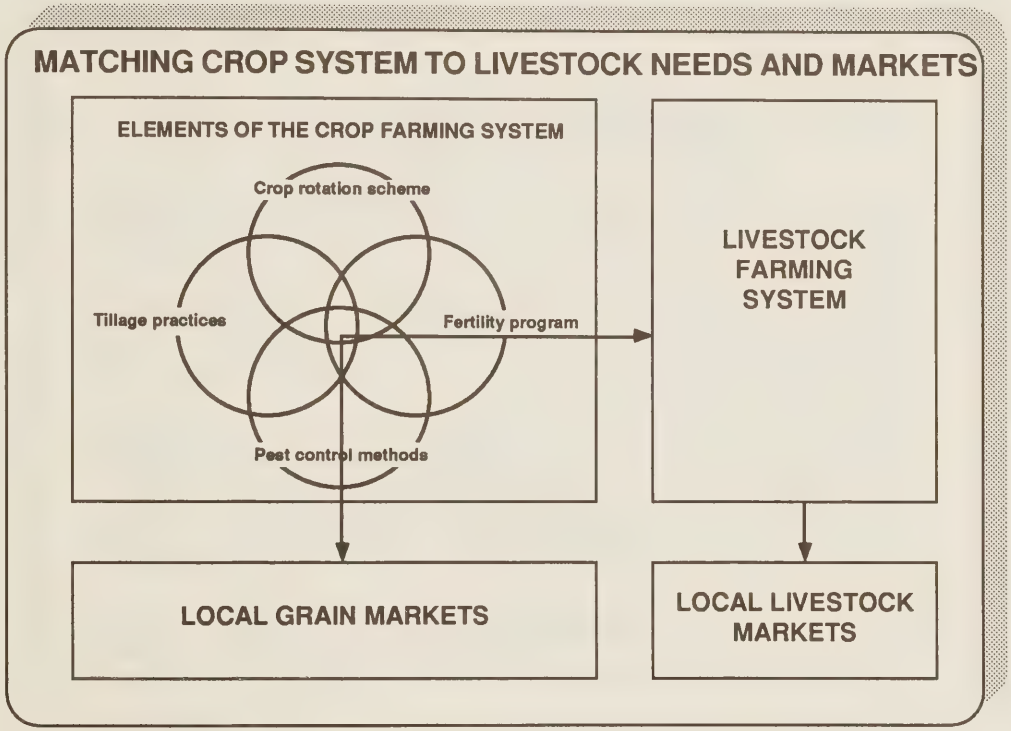
Animal manure and green manure (legume-N and hay) gradually replace Chemical-N, with following effects:

- Less denitrification, leaching, and volitilization, and less N-use by weeds -- if program is managed properly (e.g., nutrients applied at proper times, close to crop uptake)
- Mineralization rate (plant availability rate) is slow, matching long-term crop needs
- Build-up of soil organic content, structure, ion exchange capacity, and microbial activity (i.e., the "decay process," which is the production of humus, or the conversion of old plant residue into available nutrients for new plants)

Note: The fertility program can hardly be separated from the rotation scheme. Rotations are needed which allow certain crops to "scavenge" soil nitrates from previous crops, and in which cover crops can immobilize soil-N to prevent leaching and release N slowly (later) through decay processes.

Question. What about livestock? Does every sustainable-agriculture farm require livestock as a source of organic-N?

Not every sustainable-agriculture farm requires livestock, but farmers who do raise livestock must match the crop farming system not only to local grain markets but also to the crop needs of livestock.



Question. What kind of phosphate (P) and potash (K) fertility program is recommended for alternative agriculture?

Sustainable agriculture differs from conventional farming in all four elements of the farming system. -- In other words, the switch to sustainable agriculture is a complete change of farming systems. The main uncertainties of farmers making the transition are shown below.

CONVENTIONAL VS. ALTERNATIVE CROP FARMING SYSTEMS

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Pest control method	Routine application of chemical pesticides	Low input, biological controls, mechanical cultivation, crop rotation, disease-resistant cultivars, scouting for pests and beneficials; applying chemical pesticides as a last resort.

Uncertainties:

- *What happens to yields with less inputs?*
- *Will more labor and management be required?*
- *What happens to profitability – and how soon?*

Question. Is there a single good blueprint for converting to alternative agriculture?

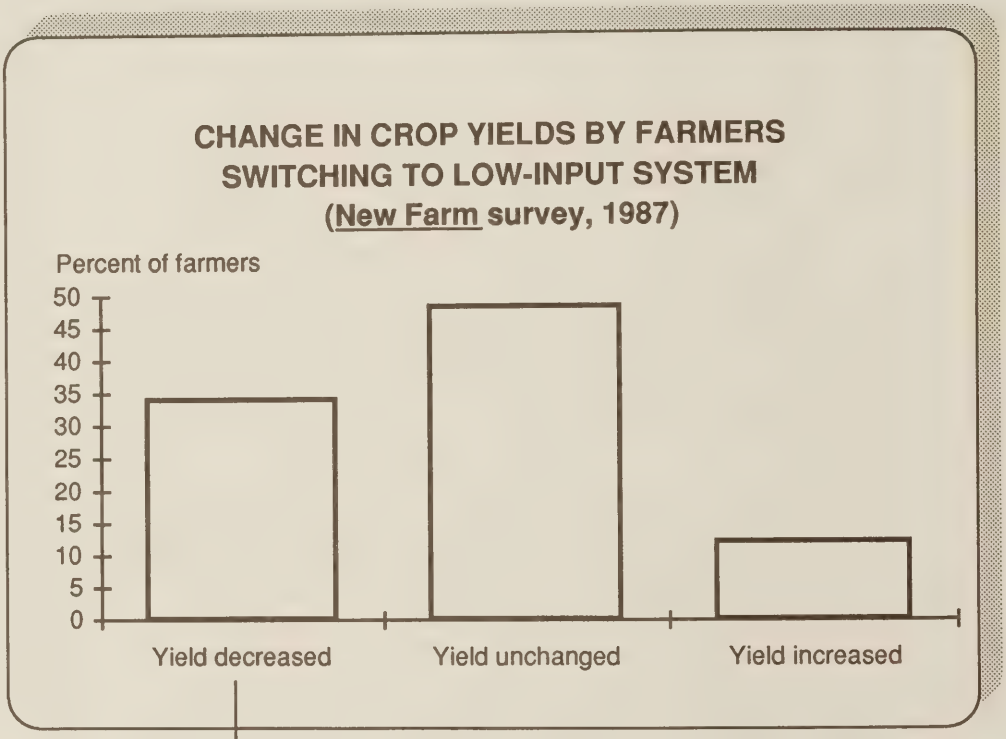
No. Alternative (sustainable) agriculture depends on far too many variables to be easily simplified into a single, nationwide approach. At least during its current formative stages, alternative agricultural technology often must be highly "site specific" for most crops and geographic locations.

WHY NO SINGLE "BLUEPRINT" EXISTS FOR SUSTAINABLE AGRICULTURE

- Agronomic principles cannot be separated from the economic and philosophical goals of the individual farmer and the individual farm;
- The best results always come from adaptation of techniques to a single farm (in terms of soil, climate, labor, equipment, facilities, livestock needs, markets, and the farmer's skill and knowledge);
- Conversion to sustainable agriculture can be a long-term project — a matter of several years rather than several months — and not enough conversions are far enough along to provide answers for each and every new problem confronted by those just beginning to convert.

<u>Question</u>. What has been the actual experience of farmers switching to alternative agriculture – do yields go up or down?

According to limited survey data, more farmers report a decrease in yields than an increase, but a large number report no change. Others have increased yields.

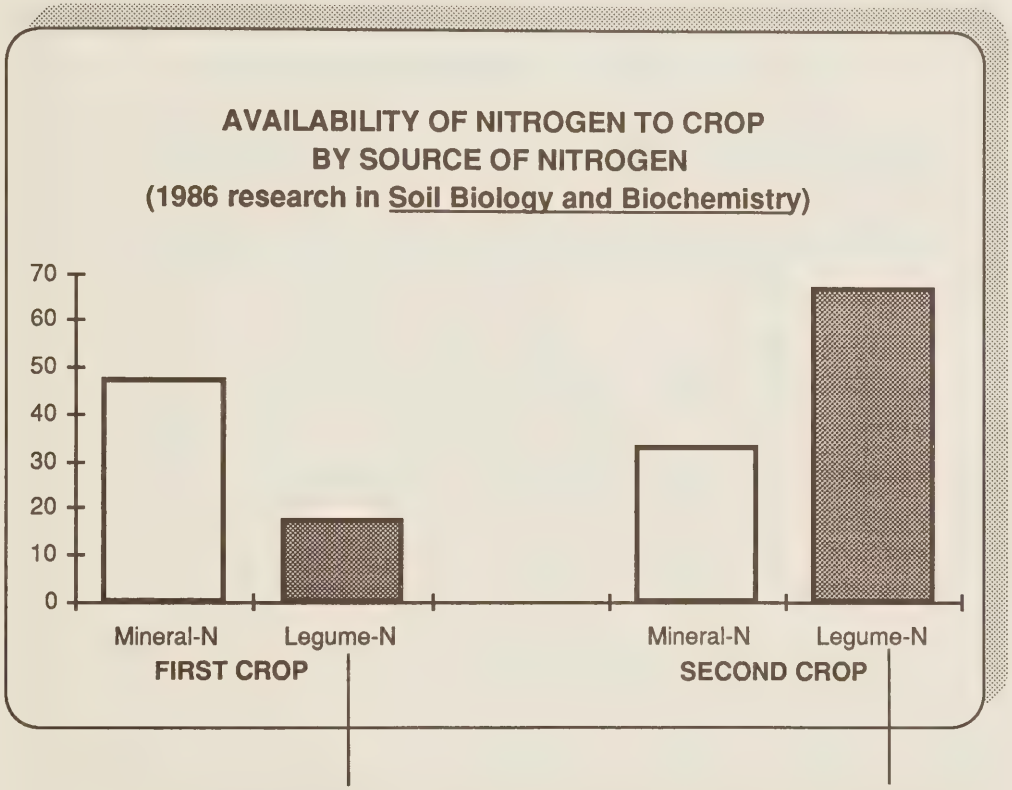


Reasons given:

- *Nutrient deficiency (cited by 48 percent)*
- *Weed problems (72 percent)*

Question. Do farmers report an improvement of yields over time with the sustainable agriculture approach?

Farmers do report better yields with time, in making the switch to sustainable agriculture. Agronomic research also supports this conclusion. Improved soil tilth and water holding capacity, reduced disease pressure and improved soil nutrition are often contributing factors. As shown below, the soil exhibits increasing availability of legume-N in its second year of legumes. ("Legume-N" refers to the nitrogen furnished by legumes such as soybeans, which naturally "fix" atmospheric nitrogen to their roots.



Land used to produce "green manure" may not simultaneously be available for producing cash crops. This lost revenue must be included in the calculation of potential farm income when converting to alternative agriculture.

Question. Can any one aspect of sustainable agriculture be named as the place to start serious work on converting from conventional farming?

Crop rotation is certainly a central element in any sustainable-agriculture farming system.

CORNERSTONE OF SUCCESSFUL TRANSITION

Developing a crop rotation that not only improves soil condition and prevents buildup of pests but that also suits the following needs of a specific farm:

- Growing appropriate crops for the soil-water-climate resources available;
- Having markets for the crops in rotation;
- Matching crops with available equipment, labor, storage and processing facilities;
- Providing the necessary labor and management for the crops grown;
- Integrating the crops with livestock nutritional needs;
- Identifying the effects that a new crop mix will have on the farm's seasonal cash flow;
- Identifying the effect that a new crop mix will have on the farm's eligibility for USDA price support payments.

How do farmers approach the transition to sustainable agriculture?

- *Gradual withdrawal of potentially harmful chemical inputs and employment of new strategies over period of years;*
- *Conversion of one field at a time, to gain knowledge and experience. (Some researchers recommend about 10 percent of cropland per year.)*

Question. What about USDA price support payments? Will these be forfeited in conversion to sustainable agriculture?

Under the 1985 farm bill, yes. In its 1990 "Alternative Agriculture" report to Congress, the U.S. General Accounting Office concluded that farm program changes must be made "To ensure that farmers have the flexibility to use a variety of management approaches, particularly those that emphasize low-input, sustainable agricultural methods." The 1990 farm bill has responded by adding extensive "flexibility" provisions.

GAO REPORT: "ALTERNATIVE AGRICULTURE, Federal Incentives and Farmers' Opinions"

Based on these results of interviewing 74 large-scale farmers in depth:

- 75 percent would diversify into additional crops if they could maintain their existing program crop acreage base;
- most are concerned that adopting alternative agriculture practices would require greater management skills and cause greater weed problems, lower yields, and lower profits;
- most believe that growing nitrogen-fixing legumes would be "more costly and time-consuming than using commercial fertilizers;"
- most believe that the best way to reduce economic risk is to participate in farm programs rather than switch to more crop diversification. . .

The GAO concluded that: "If the federal government wants to encourage farmers to adopt alternative agricultural practices," then Congress must change farm program rules and improve the research and education programs needed to deliver facts about sustainable agriculture to farmers. The 1990 farm bill's new program rules and research requirements promise just that.

Question. What is USDA doing to further the understanding and acceptance of sustainable agriculture?

USDA currently operates a broad array of programs designed to spread the word about sustainable agriculture's benefits. Launched in a small way by the '85 farm bill and significantly strengthened by the '90 bill, USDA's sustainable agriculture efforts now include major Agricultural Research Service, Cooperative State Research Service and Extension Service programs.

RESEARCH PRIORITIES FOR SUSTAINABLE AGRICULTURE

- Agronomic techniques and principles, focused on integrating specific crop-practice changes with whole-farm systems approach
- Skill and amount of labor needed, not only for production aspects but also for overall management
- Risk definition, including:
  - — labor availability vs. timely cultivation (in view of variables such as weather, growth stage, pest populations, etc.),
  - — trade-offs between quick, usually effective weed control with chemicals vs. environmental, weather, cost, and health risks
- Societal concerns, including:
  - — energy savings (less petrochemicals used in farming),
  - — environmental benefits vs. costs (and who pays?)
- How to match sustainable agriculture with existing USDA programs, both in conservation and in price support areas

The latest research shows that a farmer's successful switch to sustainable agriculture depends on using a "systems approach." Sustainable agriculture incorporates many current improvements – such as Integrated Pest Management and Best Management Practices. But the essential ingredient is that sustainable agriculture <u>treats the entire farm as a single, integrated system</u>.

Under the 1990 farm bill, specific sustainable agriculture research is authorized for $40 million per year. To judge what $40 million may buy, consider what $10 million in USDA money plus $14 million in matching state and private money already has bought in the 100 sustainable agriculture projects involving 1,860 farmers funded since 1988.

SUSTAINABLE AGRICULTURE RESEARCH STUDY RESULTS:

- cover-crop practices cut soil erosion and reduce nutrient losses affecting water quality while providing "free" nutrients for following crop;
- switching to rye or other crops that are toxic to weeds often provides effective weed control;
- lower-chemical-input corn, wheat, soybean, rice and vegetable farms can maintain or increase yields;
- use of legumes and other green manures usually pays multiple benefits;
- ridge tillage eliminates herbicide use on some soil types in Midwest corn production;
- disease-free apples can be grown in the Northeast without fungicides;
- grazing sheep in orchards both controls weeds and aids diversification;
- switching to three-year rotation boosts wheat yields sharply by breaking the cycle of disease organisms in the root zone;
- low-tech, low-cost gypsum blocks monitor soil moisture accurately enough to boost productivity while lowering costs and saving scarce water;
- manure management systems reduce environmental problems while boosting profitability;
- intensive rotational grazing cuts herbicide use and operating costs while improving year-round forage management.

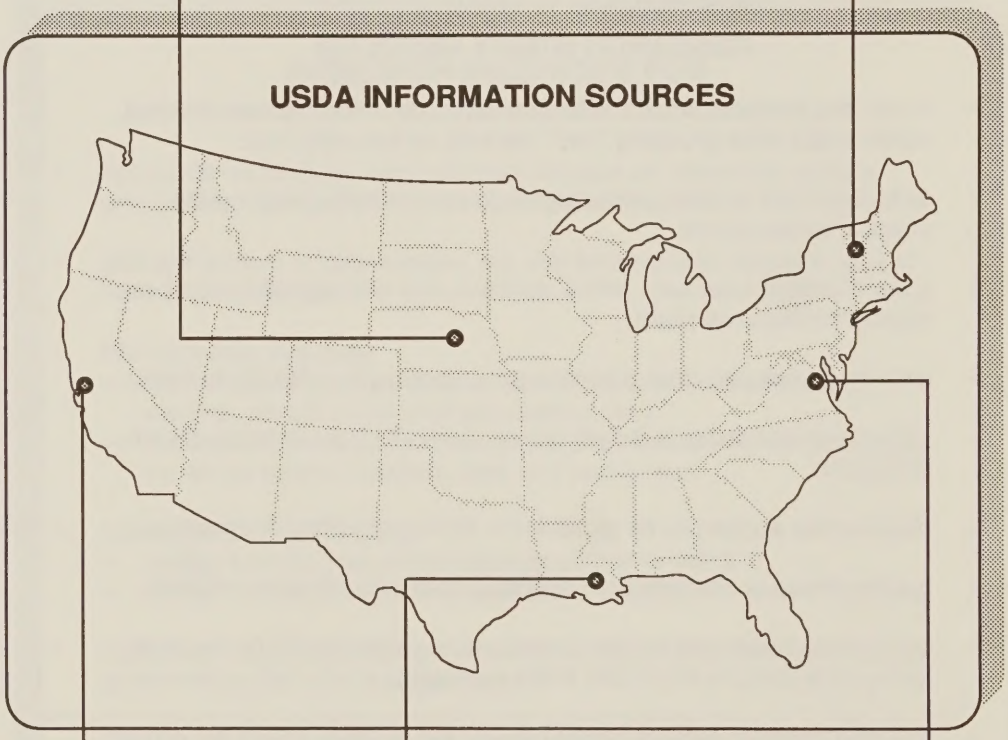
Question. How may the interested farmer or other person participate in the LISA program?

SUSTAINABLE AGRICULTURE RESEARCH AND EDUCATION PROGRAM

For further information on sustainable agriculture, contact your local Extension agent, the Soil Conservation Service, or the National Agricultural Library. For information on submitting research proposals to the LISA program, please contact any of the following centers:

North Central Region:
University of Nebraska
Lincoln, NE 68583
(402) 472-2973

Northeast Region:
University of Vermont
Burlington, VT 05405
(802) 656-2630



West Region:
University of California
300 Lakeside Drive, 6th Fl.
Oakland, CA 94612-3560
(415) 987-0029

South Region:
Louisiana State
University
Baton Rouge, LA 70893
(504) 388-4182

Alternative Farming Systems
Information Center:
National Agricultural Library,
USDA, Room 111
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